

Concern

Characterization objectives: Determine the extent of LNAPL and dissolved phase benzene, and monitor the dissolved phase plume to determine if it is migrating downgradient

Is contamination contained?

Contingency plan for containment of dissolved phase plume:

April 2016 data presented was while extraction was continuing, and gradients were inward toward the thermal treatment area. Now that extraction has been terminated, natural gradient will re-establish and containment will be lost. Groundwater table has been rising for the last ~20 years, and is now in a cobble zone at a depth of ~ 145 ft below ground surface. This zone is more permeable than the other contaminated zones below the water table (Amec estimates that this zone is 6 - 70 times more permeable than the UWBZ or CZ). Thus, contaminants will migrate downgradient in this zone much more quickly than what it has been migrating to date. Also, there is a large area downgradient in which there is no well coverage, we may not be monitoring the actual downgradient edge of the plume. **Recommendation: downgradient perimeter wells should be monitored monthly to determine when contaminants reach these wells.**

LNAPL Extent is not even bounded yet.
Additional monitoring wells are needed to verify containment

Containment was in the EBR conceptual design in the 2014 workplan, but mysteriously omitted from the 2015 Draft Final workplan

Dan Popes comments (EBR expert)

Containment is not part of the
selected remedy

Overview Slide (#3)

Is implementation consistent
with selected remedy?

Was LNAPL mass outside the
thermal treatment zone a
known element of the remedy
selection and design?

Is SEE/EBR transition
consistent with Work Plan?

The May 2014 Final RD/RA Work Plan, on page 3-2, Section 3.5, states, "The approach to remediating the LNAPL impacted zones outside the TTZ combines the technologies of groundwater recirculation with the addition of terminal electron acceptor (TEA), **and plume containment.**" (emphasis added)

Page 6-2 of the final RODA states the remedy will meet the statutory preference for reduction of toxicity, volume, mobility by "direct removal and destruction of mobilized LNAPL and dissolved contamination and natural and enhanced biodegradation" **It does not say dissolution and dispersion is a mechanism that will be employed, which will happen if contamination is not contained. Dissolution/dilution, advection and dispersion is not part of the selected remedy for the site, thus containment is necessary, especially with the rising water table.** Monitoring of this site has demonstrated that contaminant plume is expanding over time.

No - selected remedy was to treat most of LNAPL with SEE, EBR for dissolved phase, but current EBR work plan calls for treating more LNAPL with EBR than was recovered by SEE

SEE was shut down prematurely, run according to a calendar/budget while criteria established in the workplan was ignored and not met. Design SEE system was not expanded enough, and not as far as it could have been to meet objectives

We knew that some LNAPL was across Sossaman Road and we were told that was inaccessible, we thought that was all the LNAPL that was not being addressed by SEE. EBR work plan now states that more LNAPL will be treated by EBR than was recovered by SEE. Also, LNAPL across Sossaman Rd is considerably more than anticipated (more than 3,000 gallons have been extracted from the well W-37).

No - criteria of amount of steam to be injected, groundwater concentrations, and mass recovery rate were not consistent with transition criteria

See table we provided previously

USEPA policy for MNA is that contaminant sources must be controlled. “Furthermore, largely due to the uncertainty associated with the potential effectiveness of MNA to meet remediation objectives that are protective of human health and the environment, EPA expects that source control and long-term performance monitoring will be fundamental components of any MNA remedy.” (USEPA 1999, p3) Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites OSWER Directive 9200.4-17P. April 21, 1999. Office of Solid Waste and Emergency Response.

Can EBR achieve remedial objectives?

Will additional characterization and optimization be necessary to achieve objectives?
Target temperature achieved in all zones

Transition to EBR Criteria

Mass removal

No. Our bioremediation expert states that meeting the remedial objectives in the remedial timeframe set out in the RODA is 'highly uncertain' when trying to treat the extremely large amount of LNAPL that remains. He recommends that the LNAPL be recovered by SEE before the implementation of EBR, and that EBR then be monitored closely to determine if it appears to be proceeding as expected. If milestones for the EBR are not met, he recommends that there be a contingency remedy to be used to meet the RODA objectives.

Yes - in fact most of the wells that were just installed contain LNAPL, indicating that the extent of LNAPL has not been determined. But the EBR work plan does not state that the site will be fully characterized or ensure that optimization will be implemented. It states they will only 'consider' doing additional characterization or 'consider' responding to data that is less than optimal (such as groundwater data that does not show benzene degrading). The work plan does not state what criteria will be used to determine if additional characterization will be done, or if contingencies will be implemented to optimize the remediation.

EPA agrees that this criteria was met

The Target Criteria for Mass Removal given in Table 4-2 of the Final RD/RAWP is given as, "Less than 10 percent of peak removal rate." EPA response to this before it was finalized was that the peak removal rate could be very high, such that 10% of the peak removal rate is still a very high extraction rate, and we would expect that removal rate would be low before SEE was terminated. Peak rate was greater than 12,000 lbs/day, and removal rate when SEE was terminated were in the range 9 - 27% (April 20, 2016 slides, #16). The trend in vapor phase removal at that time was increasing.

Mass removal rates currently from the SVE system after dismantling of SEE are still greater than the 10% of peak criterion considering vapor alone. The SEE system was effectively removing LNAPL at the time it was shut down

Benzene concentrations

Steam Injection

Slide #16 - EBR monitoring criteria

Projected benzene
concentrations

Slide #19

AF committed to achieving
remedial objectives

Not clear where the criteria for benzene concentrations < 5,500 ug/L suitable for transition to EBR came from, **This was not part of criteria for transitioning from SEE to EBR.**

According to the benzene concentration estimates available at the time SEE was terminated, even this very lenient criteria was not met in UWBZ and CZ. The benzene concentration criteria in the RD/RAWP was 100 - 500 ug/l, according to the data provided on July 15, this is not met in wells CZ18 or LSZ37.

The actual criterion that was written in the 2014 RDRA workplan was benzene concentrations 100 - 500 ug/l "This concentration range is predicted to achieve remedial objectives within the 20 year timeframe based on modeling of groundwater contaminant attenuation after EBR.." No basis provided anywhere in the reports for >5,500 figure, this number was not discussed at all until after Amec decided to shut down SEE.

As a guideline for SEE termination, we would expect actual steam injection usage to be less than the design only if all the other data indicated clearly that the termination criteria had been met. SEE was terminated without meeting the mass removal or benzene concentration or steam injection criteria.

SEE was terminated at 94% of original projection; LNAPL extent is much greater that we were led to believe when it was designed

EBR modeling report that this table came from was reviewed, and it does not state what was the assumed benzene concentrations at the start of EBR. EPA comments on the draft EBR workplan requested that EPA's QA/QC criteria for modeling be provided; Amec declined to provide the requested QA/QC information on this modeling, therefore EPA cannot state that they agree with the model results. Also, recirculation is no longer planned as part of implementing EBR, so TEA distribution will not be as uniform as planned, reducing the effectiveness of EBR. Also, other criteria developed using the model, such as maximum well spacing, was not followed in latest EBR work plan, making it even less likely that EBR can achieve the RODA objectives in the desired time frame.

EPA and their technical consultants do not believe that EBR of ~483,000 gallons of LNAPL (see slide #15) can be achieved in 17 years; EPA agreed to EBR of dissolved phase contaminants, not for an extremely large amount of LNAPL

We believe that AF is comitted to the 20 year MNA timeframe, regardless of whether objectives can be met - it prevents EPA from requiring any further response from them while they are just monitoring.

Phased implementation allows
iterative optimization . . .

Accessibility of areas
containing LNAPL for SEE
implementation

Potential harm from following the EBR work plan

Extremely large amount of
sodium sulfate to be injected
due to extremely large
amount of LNAPL remaining

current draft final EBR work
plan does not include
recirculation to contain plume

the EBR work plan does not contain milestones for determining whether the remediation is on track and calls for modifications to the system to be 'considered' but contains no hard criteria for implementing changes to the system

Without a good initial baseline characterization of site conditions, what will they compare milestones to? They have so far declined to provide this. What/ How will they optimize? The workplan provides no insight or details.

Much of the remaining LNAPL in the UWBZ and CZ appears to be within the footprint of where SEE was implemented in the LSZ, and thus is readily accessible to SEE. Slide #17 indicates that significant LNAPL remaining in the LSZ is to the east of the SEE treatment area, not across Sossaman, where EBR wells have just been installed. If full characterization of LNAPL to the east indicates significant LNAPL in the LSZ and UWBZ, if the RODA criteria are to be met, then accessibility of this area to SEE should be re-examined (or the RODA amended to allow a significantly longer time frame to achieve the objectives).

If they had expanded the SEE design in the Upper Water Bearing Zone (UWBZ) and Cobble Zone (CZ) to match the extent of the Lower Saturated Zone (LSZ) in the first place, we probably would have been satisfied that SEE was complete. Believe the project was short changed to save money/ increase profits for Amec

1. Sodium sulfate contains arsenic - as WP is written they plan on injecting arsenic at ~ 100 times the drinking water standard. 2. The planned sodium injection rate will make the water brackish. 3. Sulfate secondary standards will be exceeded in injected water.

The groundwater around Williams already has the highest Total Dissolved Solids (TDS) readings in the State, for reasons that are unknown.

plume will spread downgradient

Hydraulic containment was in the original 2014 Final EBR workplan. Why was it removed? Ask Phil that.

